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ABSTRACT

Performance aspects of three samples (N=58) of students enrolled in computer science literacy courses for educators were studied. The person-environment congruence concept of Holland's model of vocational behavior was used to predict class performance. The model uses a classification system which arranges six vocational types in a hexagonal configuration of invariant order (realistic, investigative, artistic, social, enterprising, and conventional) and uses the relative proximity of types on the hexagon to determine the degree of congruence between a person and an environment. It was predicted, for example, that educators of the investigative type would experience more satisfaction in the course than would those of the social type. The virtual absence of individuals of the investigative type in the courses precluded a direct test of the prediction. However, correlational relationships among relevant variables were pursued. Course attendance data provided some support for the satisfaction prediction. Course grades were not differentiated by Holland type, a finding which was attributed to the predominance of Social types in the samples, and the seemingly successful efforts of the professors to tailor the courses to the non-Investigative characteristics of the students. Nine references are listed. (Author/LMM)

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Computer Science Literacy Training for Educators

A Case Study

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Abstract

Three samples of educators (N=58) enrolled in computer science literacy courses designed to fulfill the need for computer-literate elementary and secondary classroom teachers. The person-environment congruence concept of Holland's model of vocational behavior was used to predict the educators' performance; i.e., compared to those of the Social type, educators of the Investigative type were predicted to experience greater success and satisfaction in the course. The virtual absence of individuals of the Investigative type in the courses precluded a direct test of the prediction; however, correlational relationships among relevant variables were pursued. Course attendance data provided some support for the satisfaction prediction. Course grades were not differentiated by Holland type, a finding which was attributed to the predominance of Social types in the samples and the seemingly successful efforts of the professors to tailor the courses to the non-Investigative characteristics of the students. Implications for the increasing computerization of the elementary and secondary school classroom are discussed.

Computer Science Literacy Training for Educators:
A Case Study

This paper reports upon one aspect of an ongoing project undertaken by six members of the faculty in three departments of Texas Tech University. In the Department of Mathematics, the project investigators are Monty J. Strauss, Derald D. Walling, Ronald M. Anderson, and David J. Lutzer. The remaining project investigators are Nina L. Ronshausen of the College of Education and Jane L. Winer of the Department of Psychology.

The proliferation of microcomputers at ever decreasing cost has been felt in the elementary and secondary schools. When funding is available, school districts can purchase software of great usefulness and variety but often find that personnel who can use these acquisitions are less easily obtained. The lack of teacher preparation has been cited as the greatest single problem in effectively using computers in the schools (Pratscher, 1981). To remedy this problem, there must be a major national effort to provide computer science literacy training for the classroom teacher and the undergraduate education major (Rogers, 1983).

When computer training is undertaken, however, it often must proceed against the resistance of educators

to learn a new and threatening skill, one which may be difficult to perceive as relevant to their goals of being competent and effective teachers or one which is foreign to their interests and experiences. Educators, both inservice and preservice, may well consider themselves to be people-oriented service providers, not high technologists. Having chosen an occupation in which the nurturance and socialization of children is the paramount concern, educators may perceive computerization as a symbol of all that is nonnurturant and antisocial in the world of today. Having worked closely with children and their parents, educators may have excellent personal and social skills as well as competence in their subject specialization; they may be unenthusiastic about the prospect of computer intrusion into the teaching relationship.

The possibility that educators as a group would experience difficulty and dissatisfaction with the computerization of their work environment led the present investigators to embark upon an ongoing investigation of person-environment congruence based upon the model of vocational behavior developed by John L. Holland (1973). Although Holland's model cannot be described here in its entirety, it is important to note that the model permits the prediction of occupational satisfaction and success through the use of the concept of person-environment congruence.

Congruence is operationally defined in terms of Polland's occupational classification system which arranges six vocational types in a hexagonal configuration of invariant order (Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C)). The relative proximity of types on the hexagon determines the degree of congruence between a person and an environment. Using a simple and intuitive example, a Realistic person (one who prefers dealing with concrete and practical problems involving machines and the like) who is employed in a Realistic occupation (e.g., structural steel worker) may be described as highly congruent; a Realistic person in an Investigative (e.g., research mathematician) or Conventional (e.g., administrative clerk) occupation, somewhat less congruent; a Realistic person in an Artistic (e.g., makeup artist) or Enterprising (e.g., sales representative) occupation, relatively incongruent; and a Realistic person in a Social occupation (e.g., school nurse), highly incongruent. According to the model, high person-environment congruence predicts occupational satisfaction and success, with satisfaction and success becoming more problematic as the person-environment fit becomes more incongruent.

In theory, all persons and all occupational or educational environments may be described in terms of a

hierarchy of predominance of the six types. In practice, persons and environments are usually described in terms of hierarchies of one to three types. For example, a corporation lawyer may be described in terms of the single predominant type, Enterprising, or in a three-letter code, ESA, which indicates that Social is the secondary type and Artistic the tertiary type in the hierarchy. The Dictionary of Holland Occupational Codes (DHOC; Gottfredson, Holland, & Ogawa, 1982) provides three-letter Holland type classifications of all of the occupations listed in the Dictionary of Occupational Titles (DOT; U.S. Department of Labor, 1977). Other lists of occupations by Holland type exist as well. There is some variation among lists, but the DHOC is the currently accepted master list. For purposes of the present investigation, one other list is relevant, the Occupations Finder of the Self-Directed Search (Holland, 1978), which includes the occupational title "mathematics teacher" that is not included in the DHOC.

For purposes of the present investigation, the Holland type classification for elementary teacher and secondary teacher is SEC, as designated by the DHOC; for mathematics teacher, ISC, as designated by the Occupations Finder. The classifications for various computer-related occupations are taken from the DHOC as follows: computer operator (SCE), computer applications engineer (IRE), computer peripheral equipment operator

(CSR), business programmer (CRI), chief business programmer (CEI), detail programmer (CRS), engineering and scientific programmer (IRE), information system programmer (IEC), and process control programmer (ICR).

The predominance of the Investigative type in several of these computer-related occupations suggests incongruence between the typical elementary or secondary teacher (SEC), for whom the Investigative type does not appear in the three-letter code, and the computer science literacy environment. The predominance of the Conventional type in several of these occupations, however, suggests that the typical elementary or secondary teacher (SEC) or mathematics teacher (ISC) has tertiary characteristics in common with at least some of the important demands of the computer science environment; the occurrence of the Enterprising type in several of the occupations also suggests a source of congruence with the elementary or secondary teachers (SEC) who would be taught computer science literacy. However, the predominant characteristic of teachers, Social, would predict difficulty and dissatisfaction with the typical computer science environment.

Since it would be expected that educators would be strongly Social and only moderately Conventional, and would manifest relatively few Investigative characteristics, it was predicted that educators as a group would experience general dissatisfaction and

difficulty in a computer science literacy course which would likely be highly Investigative and moderately Conventional in nature. Since the increasing computerization of the educational environment would seem to bring with it an increasingly Investigative set of occupational demands, the predicted incongruence of educators with the computer science literacy course was considered to be predictive of a general person-environment incongruence in the teaching profession as computers become more prominent in the schools.

The authors (1983) reported upon one aspect of this ongoing study which pertained to the vocational personality characteristics of a sample of young undergraduate female elementary education majors with mathematics specialization (N=16) who enrolled in an experimental computer science literacy course at Texas Tech University. The Holland (1973) model of vocational behavior was the basis of estimating these students' congruence with the computer science literacy environment. The investigators concluded that the students' vocational personalities, as assessed by the Self-Directed Search (Holland, 1977), were generally incongruent with the demands of the computer science environment; surprisingly, their personalities appeared to be somewhat incongruent with their chosen occupation, elementary education, as well. The investigators

surmised that these young women had chosen their college majors on the basis of traditional stereotypes of women's work, without regard to their vocational interests. Furthermore, the investigators predicted that, upon becoming teachers, these women would become aware of their incongruence with their work environments and would seek alternative employment, perhaps in business and industry in positions which require mathematical and computer skills as well as the capacity to work with people.

The present case study reports upon some performance aspects of three samples of students who enrolled in computer science literacy courses for educators. The Holland model again served as the point of reference for the investigation.

Method

Samples

Two samples of undergraduate students (referred to as Preservice 1 and Preservice 2) and one sample of graduate students (referred to as Inservice) are reported here, for a total of 58 students, all enrolled at Texas Tech University. The Inservice and Preservice 1 samples were taught by the same professor during summer sessions one year apart. The Preservice 2 sample was taught by a different professor during a spring semester.

The two Preservice samples ($N = 16$ and 20 , respectively) included the students whose vocational personality characteristics were reported in Winer et al. (1983) and another sample. These students enrolled in the computer science literacy course in partial fulfillment of the requirements of the mathematics specialization sequence in the undergraduate elementary education major and, with the exception of one individual who had one year of teaching experience, had no professional work experience. All individuals in the Inservice sample ($N = 20$) were certified teachers; all but one, who had graduated from college the semester before enrolling in the course, had teaching experience. The teaching certification or experience of the Inservice sample was highly varied; most had taught mathematics or science in the elementary or secondary grades, but the sample included individuals with backgrounds in kindergarten, vocational agriculture, industrial arts, physical education, music, art, English, history, social studies, Spanish, humanities, reading, government, and computer technology. For the Inservice educators, enrollment in the course was by self-selection; they were not required to take the course as part of a particular program sequence.

The Inservice sample included 4 male students and 1 member of an ethnic minority. One other minority individual was included in Preservice 1. All other

members of the samples were white non-Hispanic and female. The Inservice sample was on the average older than the Preservice samples ($M = 36.3$, $SD = 7.4$, versus $M = 23.0$, $SD = 3.4$, and $M = 21.5$, $SD = 3.4$, respectively).

Instrument and Procedure

The Self-Directed Search. The students were administered the Self-Directed Search (SDS) as part of a pre-course assessment battery or as part of the course activities, as preferred by the professor. The SDS is described as a "self-administered, self-scored, and self-interpreted vocational counseling tool" (Holland, 1979, p. 1). The SDS provides scale scores for the six Holland types; these scores permit the categorization of the student into a Holland type.

The computer science literacy courses. The computer science literacy courses were provided through the Department of Mathematics in the College of Arts and Sciences as part of the mathematics specialization sequence for undergraduate students in the College of Education or as part of the Master of Arts program in the Department of Mathematics; in the latter case, students not pursuing the MA degree but interested in an educationally-oriented computer science literacy course were permitted to enroll. The two Preservice courses were roughly the same, although taught by different professors. The courses were designed to develop

computer literacy; decrease levels of computer anxiety; give hands-on experience with programmable machines to develop programming skills; give personal experience to students with computer-assisted instruction; and sharpen students' mathematical, problem-solving, and logical skills. The Inservice course differed from the Preservice courses in several ways. Although it accommodated those students who had mathematics backgrounds, the sharpening of mathematical problem-solving skills was not a goal. Instead, the development of logical problem-solving skills was emphasized through instruction in structured programming. Furthermore, the Inservice course provided greater opportunity to attack practical classroom problems, such as using a computer to keep a personalized gradebook. Those with mathematical backgrounds were provided mathematically-oriented problems among the options available to them, but those without such backgrounds had other alternatives, such as employee payroll problems. Finally, the Inservice course relied upon projects and problem-solving as the basis of letter grades; the Preservice courses were more traditionally didactic in that they relied upon examinations and percentage grades.

ResultsHolland Types

Holland types of the educators as assessed by the SDS are presented in Table 1. As expected, the majority

Insert Table 1 about here.

of the educators were of the Social or Conventional type (81.0%), the type which would be most congruent with the computer science literacy environment. Investigative was the predominant type of a minority of the educators (one individual; 1.7%). The remaining 17.3% of the educators were of the other three Holland types.

The virtual absence of Investigative individuals in the samples precluded the comparison of the performance of Investigative versus Social individuals. Instead, the results of correlational analysis of the relationship between course performance and scale scores for relevant Holland types (S, C, and I) are presented. Since the samples differed in academic level (graduate versus undergraduate), professor, and time in career and time during the academic year of taking the computer science literacy course, data from each sample were analyzed separately.

Performance

Course grades and ranks. Course grades were available in percentage form for two samples and in

letter form for one. The mean course grade for Preservice 1 was 81.5% (SD = 9.2; range 67.7% to 96.5%). The mean course grade for Preservice 2 was 82.3% (SD = 9.5%; range 60.0% to 96.0%). The median course grade for the Inservice sample was A-; the range was A+ through C-. Means and standard deviations for the three samples for relevant Holland type scales on the SDS (S, C, and I) are presented in Table 2. Correlational data pertaining to these scales and course grades among the three samples are presented in Table 3; for the Inservice sample, letter grades F through A+ were converted to numerical scores 0 through 12.

Insert Tables 2 and 3 about here.

It would be expected that course grades would correlate positively and to a statistically significant degree with scores on the Investigative scale of the SDS, since the computer science literacy course was assumed to be a predominantly Investigative environment. Results did not support expectation, although in the Preservice 1 sample, the positive correlation approached traditional levels of significance ($r = .37$, $p = .07$). Furthermore, it would be expected that grades would be moderately positively correlated with scores on the Conventional scale, given the occurrence of the Conventional type in a number of computer-related

occupations. Results supported this expectation in the case of the Inservice sample ($r = .41$, $p = .04$) but not in the case of the two Preservice samples. It was expected that grades would be unrelated or negatively correlated with scores on the Social scale, given the relatively low occurrence of the Social type in the computer environment. Results supported this expectation in two samples, but grades for the Preservice 2 sample were found to correlate positively and to a statistically significant degree with the Social scale of the SDS.

Absences. Attendance data were collected for Preservice 1 but not for the two other samples. Students in Preservice 1 were absent from 0 to 15 times out of 26 class meetings during the course ($M = 4.8$, $SD = 4.4$). There were no Investigative individuals in Preservice 1, but compared to Conventional individuals ($M = 1.7$, $SD = 1.8$), Social individuals ($M = 8.6$, $SD = 3.6$) were absent from class significantly more often ($t(12) = 4.51$, $p = .0001$). Pearson correlation coefficients of absences among Preservice 1 individuals and the S, C, and I scales on the SDS were .38 ($p = .08$), $-.40$ ($p = .06$), and $-.35$ ($p = .09$), respectively.

Discussion

The small number of students, the preponderance of the Social type, and the restricted range of types and scores all precluded a valid test of the

person-environment congruence of educators to a traditional performance variable (grades) of the computer science literacy environment. Each of the Holland types predicted to be of relevance to performance presented mixed and for the most part negative evidence for its relationship to grades in computer science literacy for educators.

Having had extensive prior experience in teaching quantitative subjects to students whose interests and skills were in other areas, both professors intuitively modified their presentation of computer science literacy to better meet the needs of these students. It is likely that the professors would have presented a rather different computer science literacy course to a class of undergraduates or graduates whose academic major was mathematics, statistics, computer science, or another quantitative field. Had the students reported here enrolled in such a class, the comparisons of interest may have been more easily accomplished: presumably, the educators with mathematics specialization would have been of predominantly Social and Conventional type, and the noneducator mathematics majors would have been of predominantly Investigative type. Under the circumstances in which the courses were offered, however, the question of whether relative person-environment congruence or incongruence would be associated with academic difficulty or poor academic

performance could not be answered. The professors may well have created a Socially-oriented computer science literacy environment in order to maximize the success of their students.

The attendance data, however, provided some evidence in support of the proposition that person-environment incongruence would be associated with dissatisfaction. The Social individuals in the Preservice 1 class had far poorer attendance records than the Conventional individuals; in fact, the mean number of absences for the Social group was about one third of the total number of class sessions in the course. Such behavior may suggest that the "user-friendly" professors were able to keep the Social students in a course they would otherwise not have taken at all. As a result, the Social students may have learned what they needed to complete the course at an acceptable level even having involved themselves somewhat minimally. The Conventional individuals' generally excellent attendance may suggest a far greater liking for the material, as would be expected of individuals who are more congruent with the computer science environment.

Compared to the Conventional individuals whose attendance suggested liking for the course, the Social individuals who may have disliked the computer science course are far more likely, according to the Holland

model, to remain classroom teachers. As suggested by Winer et al. (1983) in light of the Holland model, the Conventional individuals who enroll in computer science literacy for educators are more likely to leave the classroom for occupational environments to which they are more congruent. The Inservice sample reported here was asked why they had enrolled for the course.

Although there were many educationally-relevant reasons offered, there were a number of reasons which clearly pointed to future plans outside the educational realm. These reasons included "getting into the business field in a computer-related job," "computer-related work outside education," "business," and "real estate - aid selling." Within the educational realm, a number of reasons involved positions or responsibilities outside elementary or secondary classroom teaching, such as "vocational administration," "educational administration," "train teachers when computers get to high school," "move up to university level," "be the educational consultant for computing," and "to evaluate computer offerings as member of school board."

Although the data reported here do not differentiate between Holland types in course grades, they suggest that the type most likely to remain in the ever more computerized elementary or secondary classroom dislike the computer experience. If Holland's model reflects reality, then perhaps the computer technology

developed by the Investigative types and administered by the Conventional types will be used only grudgingly by Social types who may find themselves increasingly incongruent to their occupational environment.

Footnote

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References

- Gottfredson, G. D., Holland, J. L., & Ogawa, D. K. (1982). Dictionary of Holland occupational codes. Palo Alto, CA: Consulting Psychologists Press.
- Holland, J. L. (1973). Making vocational choices: A theory of careers. Englewood Cliffs, NJ: Prentice-Hall.
- Holland, J. L. (1977). The self-directed search. Palo Alto, CA: Consulting Psychologists Press.
- Holland, J. L. (1978). The occupations finder. Palo Alto, CA: Consulting Psychologists Press.
- Holland, J. L. (1979). The self-directed search: Professional manual. Palo Alto, CA: Consulting Psychologists Press.
- Pratscher, S. (1981). Planning for microcomputers in the classroom. Journal of Computers in Mathematics and Science Teaching, 1(1), 27-28.
- Rogers, J. B. (Ed.) (1983). Computers in pre-college education: What colleges of education should be doing. Report of a workshop held in Kansas City, June 1982. New York: ACM Education Board, SIGCSE, & SIGCUE.
- U.S. Department of Labor (1977). Dictionary of occupational titles (4th ed.). Washington, D.C.: U.S. Government Printing Office.
- Winer, J. L., Strauss, M. J., Lutzer, D. J., Walling, D. D., Anderson, R. M., & Ronshausen, N. L. (1983). Women, education, mathematics, and computers: An instance of vocational incongruence. Journal of Employment Counseling, 20, 12-18.

Table 1

Holland Types of Educators

Sample	Holland Type					
	S	C	A	E	P	I
Preservice 1	7	7	2	0	0	0
Preservice 2	14	6	1	1	0	0
Inservice	12	1	1	3	2	1
Total	33	14	4	4	2	1
Percent	56.9	24.1	6.9	6.9	3.4	1.7

Table 2

Selected Holland Type Scales:

Means and Standard Deviations

Sample	S Scale		C Scale		I Scale	
	M	SD	M	SD	M	SD
Preservice 1	36.4	6.0	31.5	10.0	19.4	6.7
Preservice 2	37.8	5.1	31.9	8.7	21.0	5.8
Inservice	35.5	6.9	24.1	9.6	24.4	10.2

Table 3

Selected Holland Type Scales and Course Grade:

Pearson Correlation Coefficients

Sample	S Scale		C Scale		I Scale	
	r	p	r	p	r	p
Preservice 1	.10	.35	-.01	.48	.37	.07
Preservice 2	.37	.05	.18	.22	.14	.27
Inservice	.10	.34	.41	.04	.10	.33